Skookumchuck Creek Bull Trout Enumeration Project

Monitor and Protect Wigwam River Bull Trout - Koocanusa Reservoir

Summary Report
2001

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February 2002

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Summary of the Skookumchuck Creek Bull Trout Enumeration Project (2001)

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ABSTRACT

This report summarizes the second year of a bull trout (*Salvelinus confluentus*) enumeration project on Skookumchuck Creek in southeastern British Columbia. An enumeration fence and traps were installed on the creek from September 6th to October 12th 2001 to enable the capture of post-spawning bull trout emigrating out of the watershed. During the study period, a total of 273 bull trout were sampled through the enumeration fence. Length and weight were determined for all bull trout captured. In total, 39 fish of undetermined sex, 61 males and 173 females were processed through the fence. An additional 19 bull trout were observed on a snorkel survey prior to the fence being removed on October 12th. Coupled with the fence count, the total bull trout enumerated during this project was 292 fish. Several other species of fish were captured at the enumeration fence including westslope cutthroat trout (*Oncorhynchus clarki lewisi*), Rocky Mountain whitefish (*Prosopium williamsoni*), and kokanee (*O. nerka*).

A total of 143 bull trout redds were enumerated on the ground in two different locations (river km 27.5-30.5, and km 24.0-25.5) on October 3rd. The majority of redds (n=132) were observed in the 3.0 km index section (river km 27.5-30.5) that has been surveyed over the past five years. The additional 11 redds were observed in a 1.5 km section (river km 24.0-25.5).

Summary plots of water temperature for Bradford Creek, Sandown Creek, Buhl Creek, and Skookumchuck Creek at three locations suggested that water temperatures were within the temperature range preferred by bull trout for spawning, egg incubation, and rearing.

ACKNOWLEDGEMENTS

Bill Westover (Ministry of Water, Land and Air Protection; Cranbrook) was responsible for arranging the funding for this project, and developing all aspects of the study. His help is greatly appreciated. Lara Neilson worked long hours to monitor the fence and tag fish, and John Hagen, Clint Tarala and Gerry Nellestijn helped with setting up and taking down the fence. We also appreciate the help from the Ministry of Water, Land and Air Protection staff (John Bell, Herb Tepper) and the Ministry of Fisheries staff (Laird Siemens) who helped with initial setup, dismantling the fence, and conducting redd surveys. Albert Chirico (Ministry of Sustainable Resource Management; Nelson) produced the maps. Thanks also to TEMBEC for allowing the enumeration fence to be setup on the property of the Skookumchuck Pulp Mill.

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BONNEVILLE POWER ADMINISTRATION

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INTRODUCTION

This project marks the second year that a fish counting fence has been operated on Skookumchuck Creek in the East Kootenay region of British Columbia (Figure 1) in order to enumerate bull trout (*Salvelinus confluentus*) that use the watershed for spawning. Skookumchuck Creek has been identified as a major spawning tributary for bull trout that live in the Kootenay River and/or Lake Koocanusa (Baxter and Baxter 2001), and as such is an important watershed for the maintenance of healthy populations of bull trout in the upper Kootenay River watershed. As bull trout populations have declined throughout the Pacific Northwest there is a growing interest by U.S. and Canadian agencies in the enumeration and protection of remaining populations. One such population that has transboundary concerns is the bull trout population that utilize Lake Koocanusa, and thus potentially uses the Skookumchuck Creek watershed for spawning.

In response to these concerns, BC Ministry of Water, Land and Air Protection (BC MWLAP) applied for and received funding from the Bonneville Power Administration (BPA) to assess and monitor the status of wild, native stocks of bull trout in tributaries to Lake Koocanusa and the upper Kootenay River. This task is one of many that was initiated under the BPA Project "Monitor and Protect Bull Trout for Koocanusa Reservoir" BPA Project Number 2000-04-00. To effectively manage and protect bull trout population(s) of the Kootenay River and/or Lake Koocanusa, BCWLAP has initiated several studies on bull trout in the East Kootenay region. These include enumeration projects on the Wigwam River (Baxter and Westover 2000) and Skookumchuck Creek (Baxter and Baxter 2001), and a large-scale radio telemetry project that is currently in progress.

Bull trout redd surveys conducted in the Skookumchuck Creek watershed documented an increase in the number of redds from 66 in 1997 to 161 in 1999. However there were limited data on the relative abundance and biological characteristics of the population that utilized the system for spawning. A limited database resulted in the initiation of this project in the fall of 2000. Results demonstrated that a significant number of bull trout used the system for spawning, and that there was a continued increasing trend in redd abundance. This project was continued in 2001, and specifically the project objectives of the study were to:

1. capture and tag post-spawning bull trout at an enumeration fence in order to estimate run size and be able to determine subsequent recaptures;
2. capture other fish species at the enumeration fence;
3. collect biological data from all sampled fish;
4. conduct redd counts to identify bull trout spawning areas in the watershed; and
5. continue to monitor water temperatures at six locations in the Skookumchuck Creek drainage.

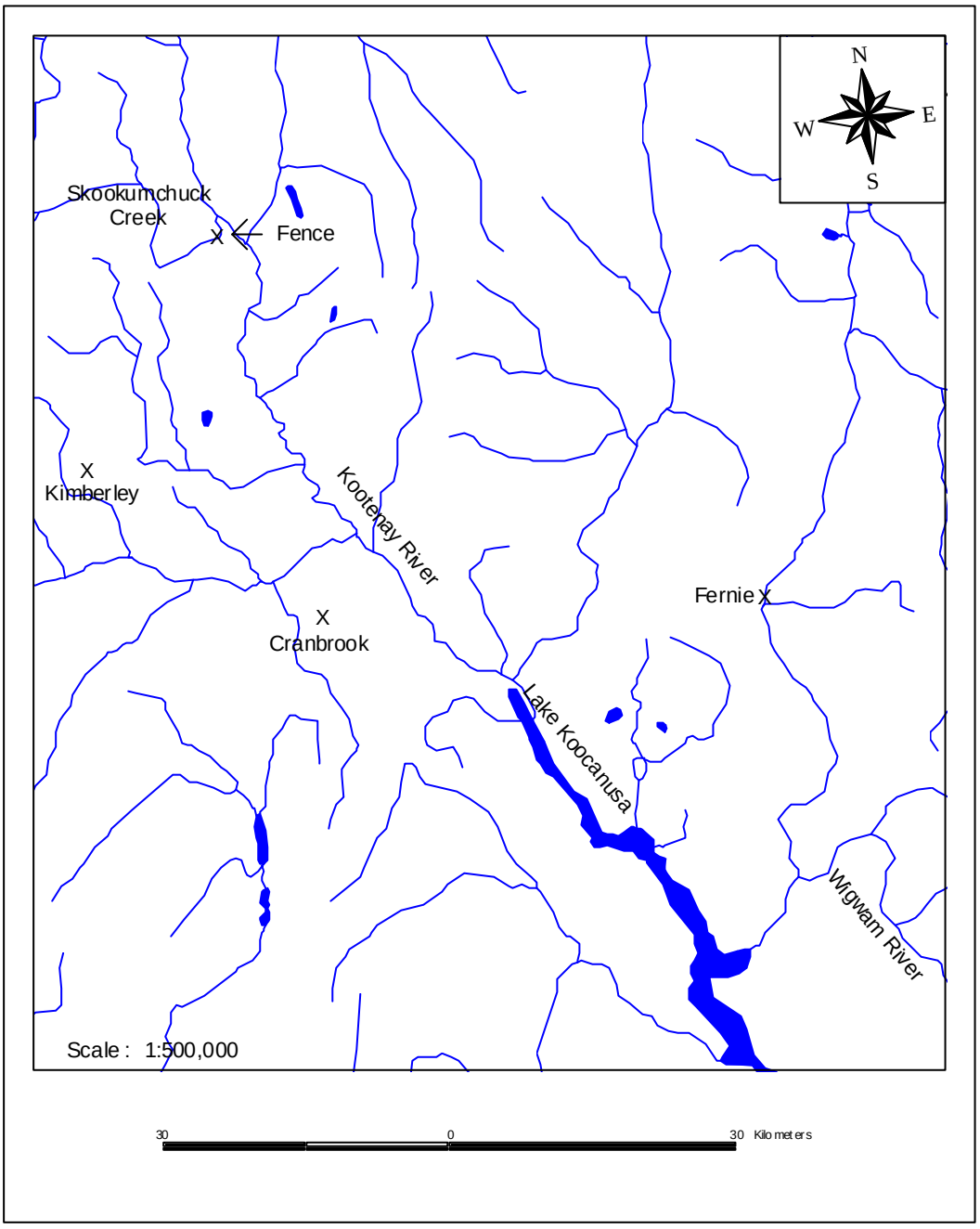

Figure 1. Fence and trap location on Skookumchuck Creek.

STUDY AREA

A description of the study area has been previously reported (Cope and Oliver 1997), and this summary is adapted from this work. Skookumchuck Creek originates in the Purcell Mountains and the watershed is within a large portion of the Purcell Wilderness Conservancy (Figure 2). The system flows in a general northeasterly direction for 42 km into the upper Kootenay River draining an area of approximately 64,236 ha. Skookumchuck Creek has three major tributaries (Buhl Creek, Bradford Creek, Sandown Creek) that contribute a significant amount of flow to the mainstem. Mean annual discharge (1949-1976) was 11.3 $m^3 \cdot sec^{-1}$ with mean monthly minimum and maximum values of 2.0 and 49.0 $m^3 \cdot sec^{-1}$ respectively (Anonymous 1977). There is a waterfall barrier at river km 32.

Fisheries resources of the Skookumchuck Creek watershed are well documented, and include bull trout, westslope cutthroat trout (*Oncorhynchus clarki lewisi*), Eastern brook trout (*Salvelinus fontinalis*), Rocky Mountain whitefish (*Prosopium williamsoni*), and rainbow trout (*O. mykiss*) (Cope and Oliver 1997). The Skookumchuck Creek watershed was also sampled as part of a broad scale bull trout metapopulation genetics study, and bull trout were confirmed in the mainstem of Skookumchuck Creek, Bradford Creek, and Sandown Creek (Baxter and Oliver 1997).

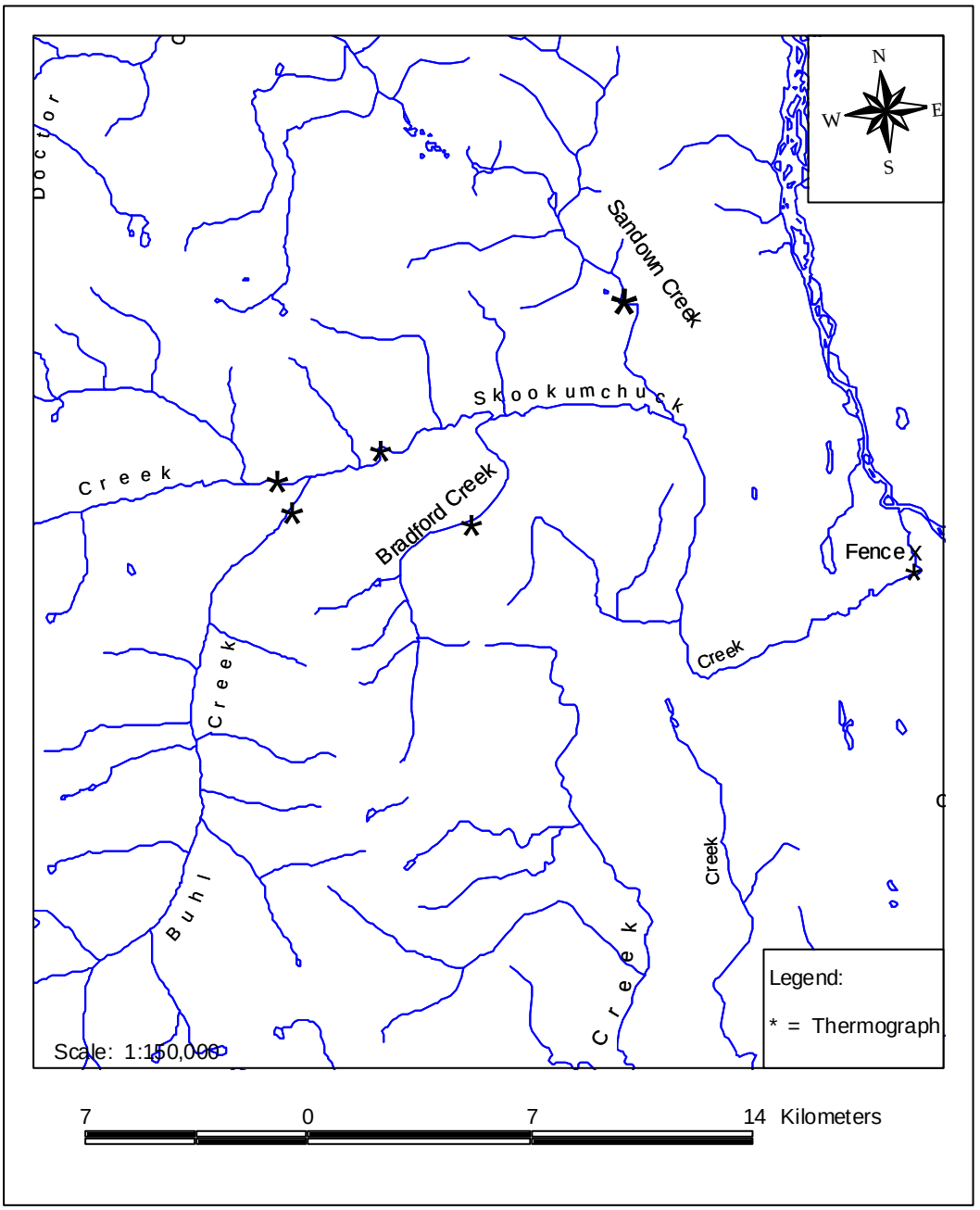

Figure 2. Map of the Skookumchuck Creek watershed.

METHODS

Trapping

A 5.0 cm square coated wire mesh fish enumeration fence supported by T-bars was installed across Skookumchuck Creek on September 6th, approximately one km upstream of the Skookumchuck Creek/Kootenay River confluence. The location of the fence was moved approximately 30 m upstream from the previous year due to lower water levels experienced in the fall of 2001. The fence was set up and operated during the fall in order to capture downstream migrating bull trout kelts, and to minimize the effect the fence might have on the upstream migration of spawning bull trout. Upstream and downstream traps constructed of 2.5 cm wire mesh were used in conjunction with the fence to capture and hold bull trout prior to processing. Moveable 2.5 cm mesh wire panels were then hinged to the upstream side of the fence in order to allow debris to be removed.

Each trap was checked a minimum of twice daily by a two person crew from September 6th to when the fence was removed on October 12th. Morning checks occurred between 0600 and 0800 hours and evening checks between 2000 and 2400 hours.

Enumeration, Measurement, and Tagging

All captured fish were anaesthetized using clove at a concentration of 100 PPM (2 mL in 20 L) in a 100 L cooler. Fish were examined for the presence of previous tags and spawning condition. The fish were then subsequently measured for weight (g) and fork length (cm), sexed, and finally tagged with a Floy tag placed at the base of the dorsal fin. Floy tags used for this study were Floy FD-94 T-Bar anchor tags, with 1 inch bare monofilament below the tubing, and were inserted with a Mark II super heavy duty tagging gun having a one inch insertion using Mark II long, regular needles (outside diameter = 0.22 cm). Four fish were also radio tagged at the fence as part of the broad scale study of bull trout migration patterns in the Kootenay River.

Prior to the fence being removed, Skookumchuck Creek (from the Torrent Road bridge crossing to the fence site) was surveyed by snorkeling to determine the number of bull trout upstream of the fence prior to removal.

Other Species

Other fish that were sampled at the enumeration fence were also anaesthetized and then identified to species, enumerated, sexed (where possible), and measured for fork length (cm). After recovery the fish were released in the direction they were migrating.

Redd Counts

On October 3rd, bull trout redds were enumerated by two 2-person crews that surveyed the mainstem of Skookumchuck Creek. One crew surveyed a 3.0 km section of the stream from river km 27.5 to 30.5. This same section has been surveyed in each of the last 4 years. The other crew surveyed a 1.5 km section of Skookumchuck Creek from river km 24.0 to 25.5. This was the second year that this section of stream has been sampled.

Water Temperature Monitoring

A water temperature monitoring program was originally established as part of this project in summer of 2000. At this time six Optic StowAway? Temp thermographs were deployed throughout the Skookumchuck watershed. Thermographs were deployed in the mainstem of Skookumchuck Creek at three locations (fence site, upper Skookumchuck Creek above Buhl Creek, and at km 39.5 on the Skookumchuck Creek Forest Service Road) and in Buhl Creek, Bradford Creek, and Sandown Creek (Figure 2). The thermographs were downloaded for a second time on September 25th 2001 in order to retrieve data prior to freeze up.

RESULTS

Trapping

The fence was set up and fishing after approximately two hours of installation time on September 6th. Site conditions experienced during the study period were extremely favorable, and the fence remained operational throughout the entire study period.

Enumeration, Measurement, and Tagging

During the study period, a total of 273 bull trout were sampled through the enumeration fence (Appendix I). Of the 273 fish sampled, 37 fish had a Floy tag present from previous sampling and one fish had a Floy tag and radio tag present from previous sampling (see Appendix I). Of the remaining fish, 231 were tagged with a Floy tag, and four were tagged with both a Floy and radio tag (Appendix I).

Of the 273 fish that were passed through the fence, one was caught for the first time migrating upstream (0.4%), while 272 (99.6%) were caught for the first time heading downstream (Figure 3).

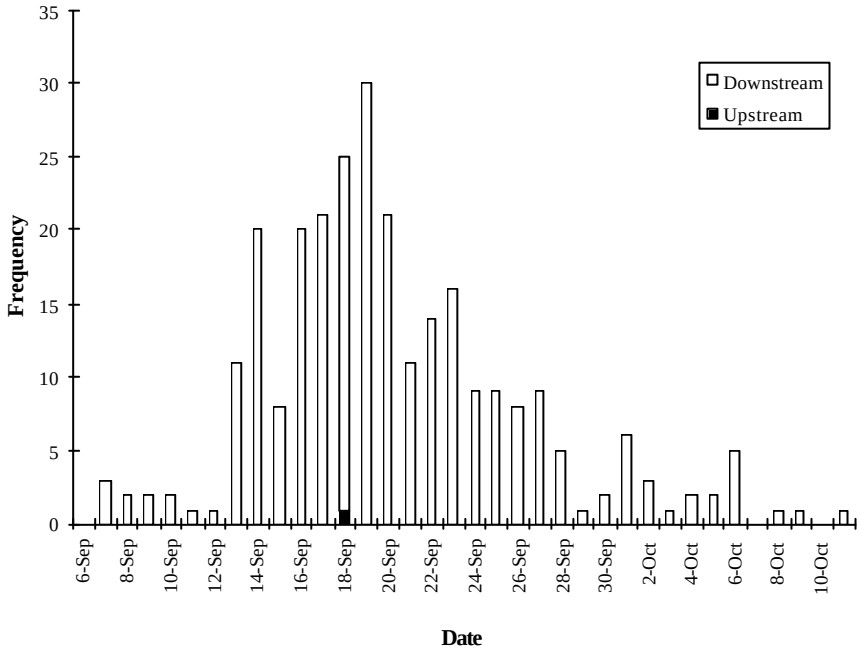

Figure 3. Frequency and timing of bull trout migration through Skookumchuck Creek enumeration fence between September 6th and October 12th 2001. The total number of fish captured was 273 individuals.

Length and weight were determined for all of the 273 bull trout captured. In total, 39 fish of undetermined sex, 61 males and 173 females were processed through the fence. The average length and weight of undetermined sex, males, females, and both sexes combined are presented in Table 1. Length frequency distributions of bull trout of undetermined sex and male and female bull trout are presented in Figure 4.

Table 1. Range, mean fork length, and mean weight of bull trout captured at the Skookumchuck Creek enumeration fence between September 6th and October 12th 2001.

		Fork Length (cm)		Weight (g)	
	n	Range	Mean	Range	Mean
Undetermined	39	40-49	45	600-1200	877
Males	61	52-92	74	1000-7500	4084
Females	173	50-88	65	900-6300	2557
Combined	273	40-92	64	600-7500	2660

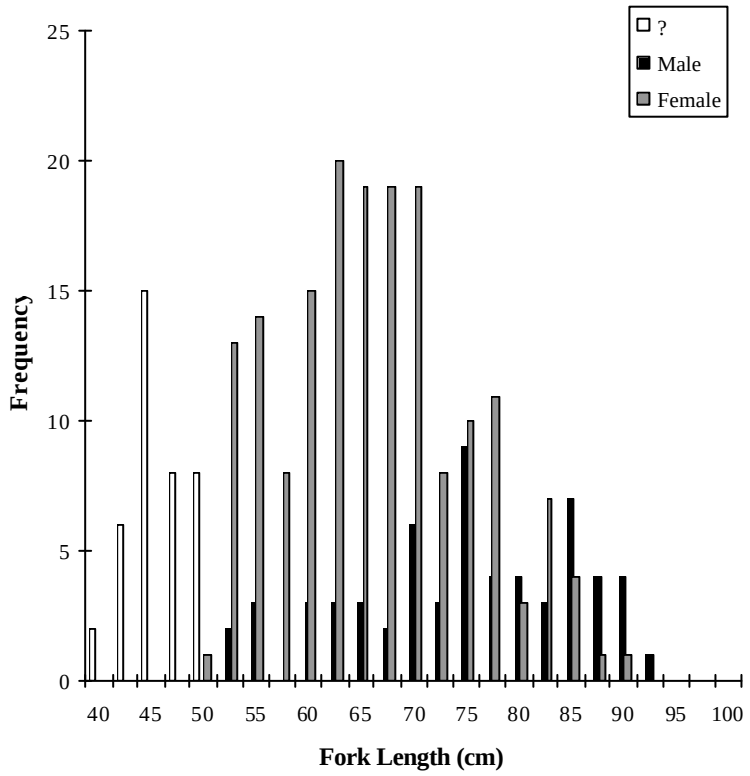

Figure 4. **Length frequency distribution of bull trout captured at the Skookumchuck Creek enumeration fence in 2001.**

A total of 19 bull trout were observed on the snorkel survey prior to the fence being removed on October 12th. Coupled with the fence count, the total bull trout count during this project was 292 fish. Of the 273 sexed fish, a total of 173 were females and 61 were males. For a sex ratio of 2.8:1 females to males.

Thirty eight of the bull trout that were enumerated at the fence were recaptures. Of these, 37 (13.9%) were repeat spawners from the previous year. The other recapture was a fish that was originally tagged in the Bull River (D. den Biesen, Environmental Technician, BC Hydro, Castlegar, B.C.; personal communication). The mean fork length of recaptured male and female bull trout increased 1 cm and 4 cm, respectively (Table 2).

Table 2. Comparison of fork lengths of bull trout recaptured at the Skookumchuck Creek enumeration fence in 2001 that were initially tagged in 2000. These fish were repeat year spawners.

		Fork Length 2000 (cm)		Fork Length 2001 (cm)		Average Mean
	n	Range	Mean	Range	Mean	Growth (cm)
Males	1	n/a	71	n/a	72	1
Females	36	47-84	68	54-86	72	4
Total	37	47-84	68	54-86	72	4

Other Species

Several other species of fish were captured at the enumeration fence including westslope cutthroat trout, Rocky Mountain whitefish, and kokanee.

In total seven westslope cutthroat trout were captured migrating downstream. One fish was a recapture from the previous year and had grown 4.0 cm. The remaining fish were measured for fork length and weight, were Floy tagged and released (mean length = 39 cm, mean weight = 871 g). Large numbers of Rocky Mountain whitefish (n=227) were also sampled at the fence, with all of the fish migrating downstream (mean length = 24 cm; Figure 5).

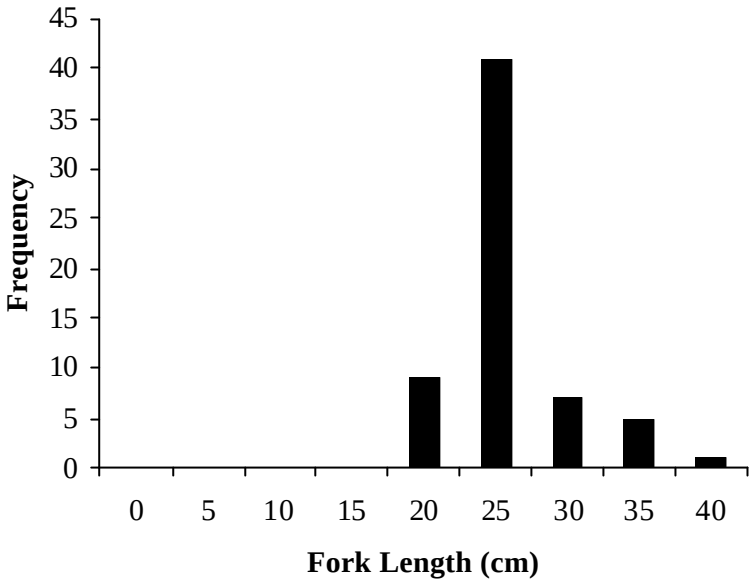

Figure 5. Length frequency distribution of Rocky Mountain whitefish sampled at the Skookumchuck Creek enumeration fence in 2001.

The fence was also operated during the spawning period of kokanee. Despite this, few kokanee were sampled at the fence in 2001. In total three kokanee were sampled at the fence, all of which were males. These fish averaged 25 cm in fork length. No sucker (*Catostomus* spp.) or Eastern brook trout (*Salvelinus fontinalis*) were sampled at the fence in 2001.

Redd Counts

A total of 143 bull trout redds were enumerated on the ground on October 3rd. The majority of redds (n=132) were observed in the 3.0 km index section (river km 27.5-30.5) that has been surveyed over the past five years. The additional 11 redds were observed in a 1.5 km section (river km 24.0-25.5). The increasing trend in the number of bull trout redds present in the study area over the past four years did not continue in 2001 (Figure 6).

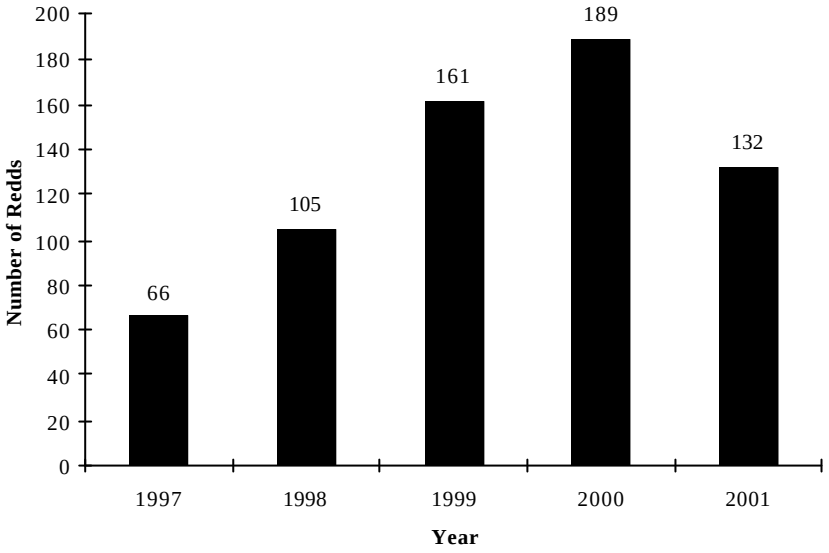

Figure 6. Total number of bull trout redds counted in the index section of Skookumchuck Creek in 2001 compared to previous counts in other years.

Water Temperature Monitoring

We were able to retrieve all thermographs for downloading on September 25th including the thermographs that could not be retrieved in the fall of 2000 (Buhl Creek and the upper Skookumchuck Creek above Buhl Creek). Summary plots of water temperature for Bradford Creek (Figure 7), Sandown Creek (Figure 8), Skookumchuck Creek at km 39.5 (Figure 9), Skookumchuck Creek at the fence site (Figure 10), Buhl Creek (Figure 11), and upper Skookumchuck Creek (Figure 12) suggested that water temperatures were within the range of those preferred by bull trout (see Baxter and McPhail 1996). Thermograph readings at km 39.5 and upper Skookumchuck Creek indicate that the thermographs became dewatered in August and September due to low flows.

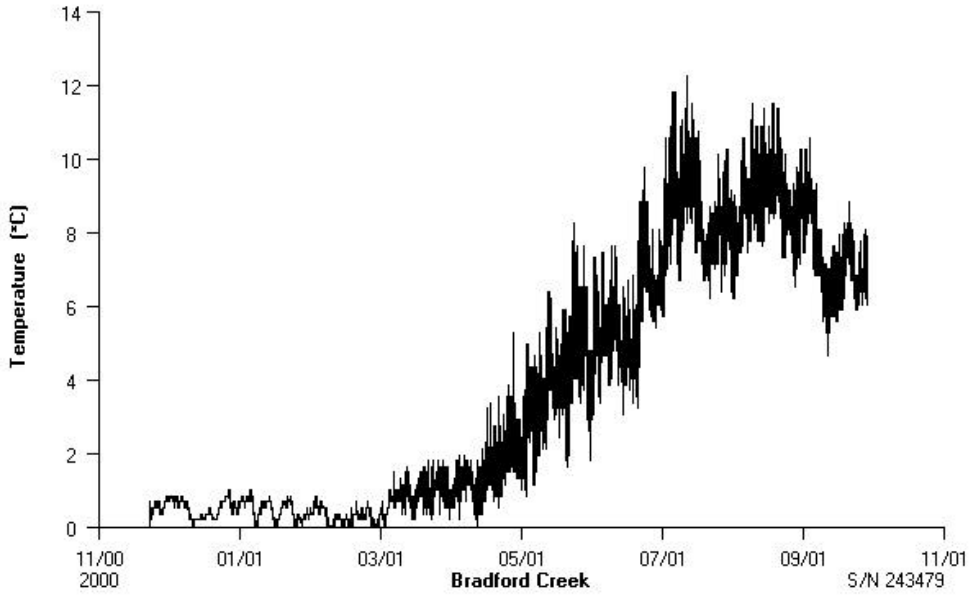

Figure 7. Water temperature profile for Bradford Creek.

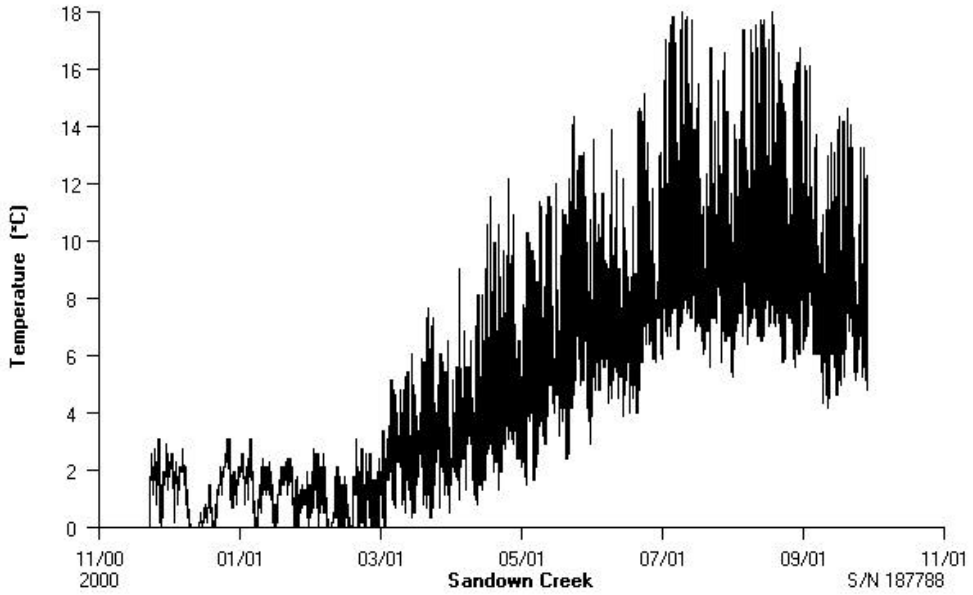

Figure 8. Water temperature profile for Sandown Creek.

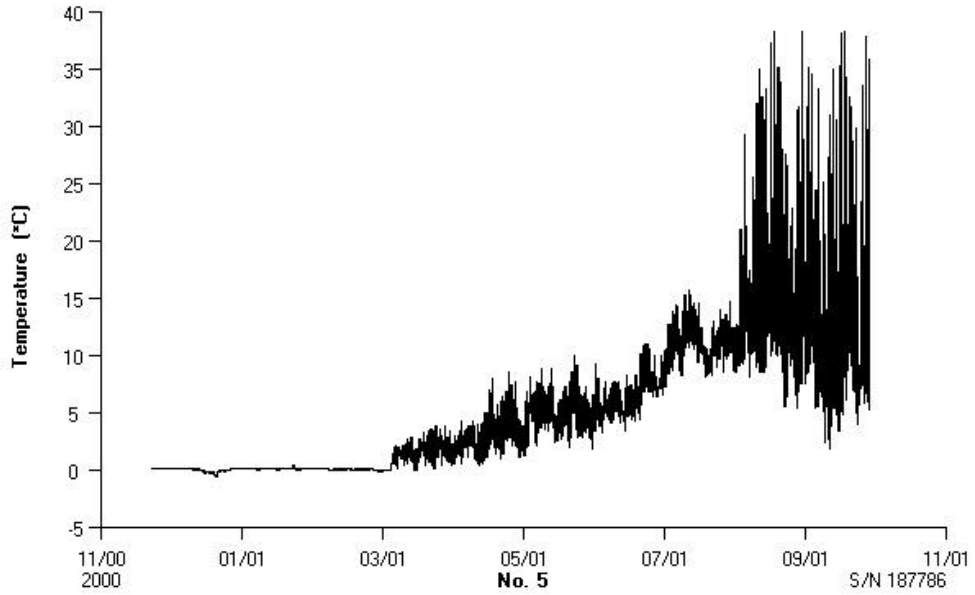

Figure 9. Water temperature profile for Skookumchuck Creek (km 39.5).

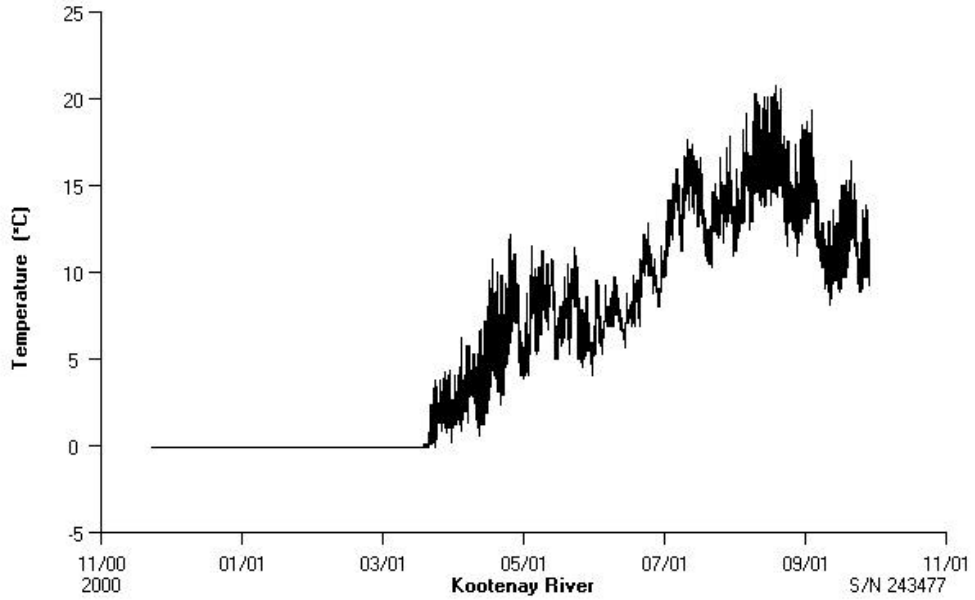

Figure 10. Water temperature profile for Skookumchuck Creek (fence site).

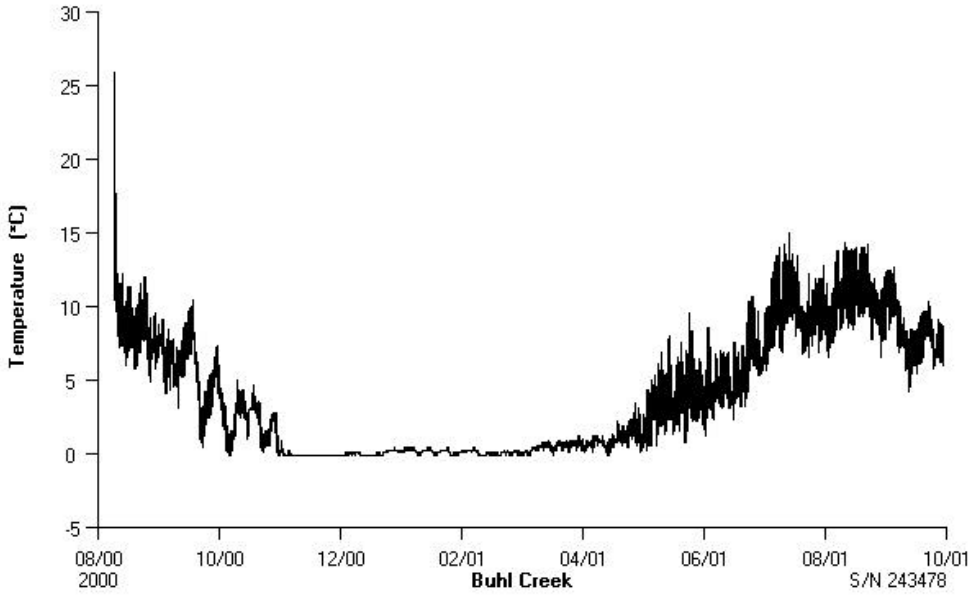

Figure 11. Water temperature profile for Buhl Creek.

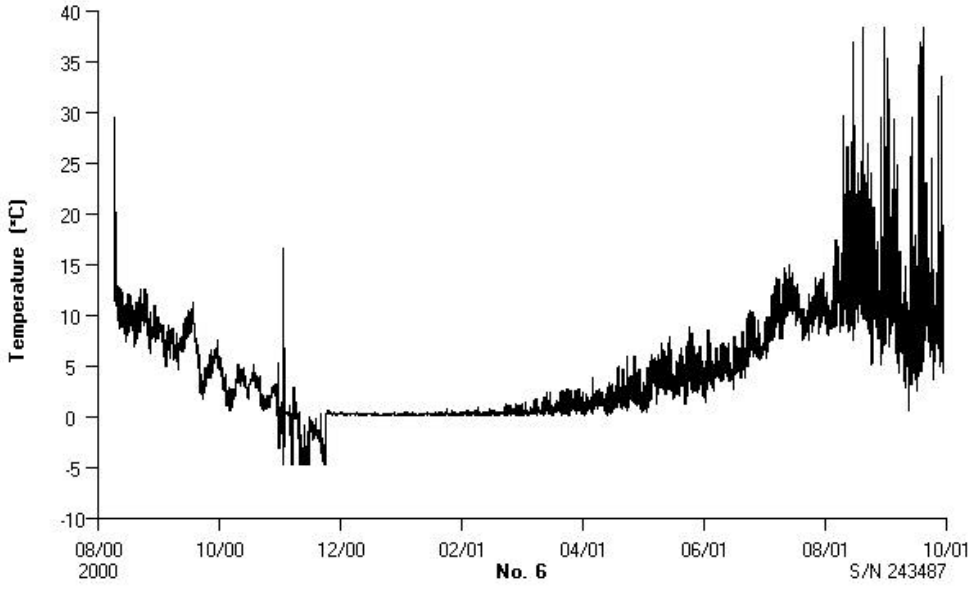

Figure 12. Water temperature profile for Skookumchuck Creek (above Buhl Creek).

DISCUSSION

It has been suggested that to ensure the long term persistence of salmonid populations, research must focus on the needs of specific life-history forms of different species (McIntyre and Reimen 1995). With reference to bull trout populations, this research can include studies on life-history (migration timing and the identification of critical habitats) and on monitoring long term abundance trends (populations estimates and redd counts). In British Columbia during the mid and late 1990's there was an increase in the number of research projects initiated in response to suspected declines in bull trout abundance throughout the province. In the East Kootenay's a number of projects and management regulations were put in place to restore and monitor upper Kootenay River bull trout populations. Conservative fishing regulations including a reduction in harvest in 1996/1997, and a complete ban on harvest in the winter months in 1999/2000, have resulted in an increase in bull trout escapement in several systems. Programs have been developed to monitor the increasing trend in abundance on several key tributaries.

Two conservation issues that can lead to the decline of native fish populations in North America are habitat destruction (Frissell 1993) and the reduction of the size of populations to abundance levels where extinction is a real possibility (McElhaney et al. 2000). For many populations of salmonids, not having data regarding these two issues has likely lead to population extinctions that have gone unnoticed. The establishment of annual monitoring programs for bull trout populations in the East Kootenay region has been key in enabling informed management decisions, identifying and protecting critical habitats, and ensuring that abundance levels do not drop below conservation minimums. During the two years that this project has been undertaken in the Skookumchuck Creek watershed, data has been collected on critical habitats necessary for reproduction, and on abundance trends through redd counts and the operation of the enumeration fence. Specifically the project has identified the extreme importance of mainstem habitat from 27.5-30.5 km as providing the majority of spawning habitat.

Although the trend of increasing redd numbers did not continue in the fall of 2001, similar numbers of bull trout were enumerated this year (n=292) compared to 2000 (n=319). Perhaps the decrease in the number of redds observed this year (despite similar abundance levels) can be attributed to the large number of immature bull trout enumerated in 2001. This year a total of 39 bull trout of undetermined sex were identified compared to only one if the fall of 2000. These fish did not exhibit any signs of sexual dimorphism or coloration, and it is felt that they did not spawn this fall. Similar "types" of bull trout were observed in the lower Wigwam River system in the fall of 2001, and it was also felt that they were immature fish (B. Westover, Fisheries Biologist, BC MWLAP, Cranbrook, B.C; personal communication). It is possible that these fish represent an extremely successful recruitment event, and were subadult bull trout moving into the system to feed. These smaller immature bull trout were also responsible for reducing the mean length of spawners in 2001 compared to 2000.

As the use of redd counts is an useful technique to monitor trends in bull trout abundance (Rieman and Myers 1997), it is important that the program continue on an annual basis. It is

also possible the program study area be expanded due to the probability that as bull trout escapement increases the range of spawning habitats used will also increase. Large spawners have also been sampled in Bradford and Sandown Creek (Baxter and Oliver 1997), and these two sub-basins should at be least considered for inclusion in redd counts during 2002.

REFERENCES

Anonymous. 1977. Historical streamflow summary, British Columbia. Inland Waters Directorate, Water Survey of Canada, Ottawa, Canada, 758 p.

Baxter, J.S., and J.D. McPhail. 1996. Bull trout spawning and rearing habitat requirements: summary of the literature. B.C. Fisheries Technical Circular No. 98.

Baxter, J.S., and G.G. Oliver. 1997. Bull trout metapopulation structure in the upper Kootenay River: fish and fish habitat summary data. Report prepared for Ministry of Environment, Lands and Parks, Victoria, B.C. Report prepared by Interior Reforestation Co. Ltd.

Baxter, J.S., and W.T. Westover. 2000. An Overview of the Wigwam River Bull Trout Program (1995-1999): Habitat Conservation Trust Fund Final Report. Fisheries Project Report KO 58, vi + 23 p.

Baxter, J.S., and J.T.A. Baxter. 2001. Summary of the Skookumchuck Creek bull trout enumeration project (2000). Report prepared for Ministry of Environment, Lands and Parks, Cranbrook, B.C. Report prepared by Baxter Environmental, Nelson, B.C.

Cope, R.S., and G.G. Oliver. 1997. Fish and Fish Habitat Inventory for the Canal Flats Division. Report prepared for Crestbrook Forest Industries Ltd. (Canal Flats Division), Cranbrook, British Columbia by Interior Reforestation Co. Ltd., Cranbrook, British Columbia, xii + 114 p + 5 appendices + maps.

Frissell, C.A. 1993. Topology of extinction and endangerment of native fishes in the Pacific Northwest and California (U.S.A.). Conservation Biology 7:342-354.

McElhany, P., M.H. Ruckelhaus, M.J. Ford, T.C. Wainwright, and E.P. Bjorkstedt. 2000. Viable salmonid populations and the recovery of evolutionarily significant units. U.S. Dept. Commer., NOAA Tech. Memo. NMFS-NWFSC-42, 156 p.

McIntyre, J.D., and B.E. Rieman. 1995. Westslope cutthroat trout. Pages1-15 in M.K. Young, editor. Conservation assessment for inland cutthroat trout. US Forest Service General Report RM-256.

Rieman, B.E., and D.L. Myers. 1997. Use of redd counts to detect trends in bull trout (*Salvelinus confluentus*) populations. Conservation Biology 11:1015-1018.

Appendix I. Length, weight, sex and tag number of bull trout captured at the Skookumchuck Creek fence in 2001.

Date	Length (cm)	Weight (g)	Sex	Direction	Spag #	Tag Color	Comment
07-Sep	510	1000	F	? ?	251	GREEN	KELT
07-Sep	490	1000	?	? ?	252	GREEN	
07-Sep	490	1000	?	? ?	253	GREEN	
08-Sep	470	900	?	? ?	254	GREEN	
08-Sep	470	800	?	? ?	255	GREEN	
09-Sep	560	1500	F	? ?	256	GREEN	PHOTO #1&2, ROLL #1
09-Sep	470	800	?	? ?	257	GREEN	
10-Sep	520	900	F	? ?	259	GREEN	FLOY G-258 NOT USED
10-Sep	510	1000	F	? ?	260	GREEN	
11-Sep	600	1600	F	? ?	156	GREEN	RECAPTURE
12-Sep	610	1900	F	? ?	261	GREEN	PHOTO #3&4,ROLL #1
13-Sep	440	800	?	? ?	262	GREEN	
13-Sep	690	2600	F	? ?	263	GREEN	PHOTO #5&6, ROLL #1
13-Sep	570	1500	F	? ?	264	GREEN	
13-Sep	510	1000	F	? ?	265	GREEN	
13-Sep	490	900	?	? ?	266	GREEN	
13-Sep	610	1800	F	? ?	267	GREEN	
13-Sep	510	1100	F	? ?	268	GREEN	
13-Sep	420	600	?	? ?	269	GREEN	
13-Sep	570	1500	F	? ?	270	GREEN	
13-Sep	535	1200	F	? ?	271	GREEN	
13-Sep	470	900	?	? ?	272	GREEN	
14-Sep	550	1300	F	? ?	273	GREEN	
14-Sep	740	3100	F	? ?	274	GREEN	
14-Sep	790	3900	F	? ?	050	GREEN	RECAPTURE
14-Sep	530	1300	F	? ?	275	GREEN	
14-Sep	730	3800	F	? ?	276	GREEN	
14-Sep	710	3000	F	? ?	277	GREEN	
14-Sep	660	2200	F	? ?	015	GREEN	RECAPTURE
14-Sep	570	1600	F	? ?	278	GREEN	
14-Sep	510	1100	F	? ?	279	GREEN	
14-Sep	570	1500	F	? ?	280	GREEN	
14-Sep	880	>5000	F	? ?	281	GREEN	PHOTO #9&10,ROLL #1, GIRTH 41cm
14-Sep	680	2300	F	? ?	021	GREEN	RECAPTURE
14-Sep	780	3800	F	? ?	282	GREEN	
14-Sep	690	2500	F	? ?	012	GREEN	RECAPTURE
14-Sep	730	4200	F	? ?	283	GREEN	
14-Sep	520	1100	F	? ?	284	GREEN	
14-Sep	420	600	?	? ?	285	GREEN	
14-Sep	630	1800	F	? ?	286	GREEN	
14-Sep	615	1800	F	? ?	287	GREEN	
14-Sep	850	>5000	F	? ?	011	GREEN	RECAPTURE, GIRTH 35.5cm
15-Sep	510	1000	F	? ?	288/289	GREEN	DOUBLE TAGGED

15-Sep	500	1000	F	? ?	290	GREEN	
Date	**Length (cm)**	**Weight (g)**	**Sex**	**Direction**	**Spag #**	**Tag Color**	**Comment**
15-Sep	430	700	?	? ?	291	GREEN	
15-Sep	730	3100	F	? ?	037	GREEN	RECAPTURE
15-Sep	760	3500	F	? ?	292	GREEN	
15-Sep	605	1600	F	? ?	033	GREEN	RECAPTURE
15-Sep	480	800	?	? ?	293	GREEN	
15-Sep	600	1600	F	? ?	294	GREEN	
16-Sep	600	1700	F	? ?	295	GREEN	
16-Sep	860	5000	F	? ?	034	GREEN	RECAPTURE
16-Sep	690	2800	F	? ?	296	GREEN	
16-Sep	730	3000	F	? ?	297	GREEN	
16-Sep	730	3000	F	? ?	045	GREEN	RECAPTURE
16-Sep	700	2900	F	? ?	298	GREEN	
16-Sep	515	1100	F	? ?	299	GREEN	
16-Sep	670	2500	F	? ?	300	GREEN	
16-Sep	625	1900	F	? ?	301	GREEN	
16-Sep	540	1200	F	? ?	302	GREEN	
16-Sep	530	1200	F	? ?	303	GREEN	
16-Sep	620	2000	F	? ?	041	GREEN	RECAPTURE
16-Sep	430	700	?	? ?	304	GREEN	
16-Sep	480	900	?	? ?	305	GREEN	
16-Sep	640	2300	F	? ?	306	GREEN	
16-Sep	445	800	?	? ?	307	GREEN	
16-Sep	620	2000	F	? ?	308	GREEN	
16-Sep	650	2500	F	? ?	309	GREEN	
16-Sep	690	3100	F	? ?	310	GREEN	
16-Sep	590	1700	F	? ?	311	GREEN	
17-Sep	525	1100	M	? ?	312/313	GREEN	DOUBLE TAGGED
17-Sep	775	4500	F	? ?	314	GREEN	
17-Sep	570	1600	F	? ?	315	GREEN	
17-Sep	760	3600	F	? ?	029	GREEN	RECAPTURE
17-Sep	670	2300	F	? ?	316	GREEN	
17-Sep	780	4300	F	? ?	040	GREEN	RECAPTURE
17-Sep	685	2800	F	? ?	317	GREEN	
17-Sep	760	4500	F	? ?	318	GREEN	PHOTO #11&12, ROLL #1
17-Sep	720	3000	F	? ?	189	GREEN	RECAPTURE
17-Sep	510	1200	F	? ?	319	GREEN	
17-Sep	715	2900	F	? ?	320	GREEN	
17-Sep	660	2400	F	? ?	321	GREEN	
17-Sep	755	3500	F	? ?	038	GREEN	RECAPTURE
17-Sep	700	2400	F	? ?	322	GREEN	
17-Sep	810	4500	F	? ?	053	GREEN	RECAPTURE
17-Sep	760	3800	F	? ?	111	GREEN	RECAPTURE
17-Sep	620	1900	F	? ?	323	GREEN	
17-Sep	810	4400	F	? ?	141	GREEN	RECAPTURE
17-Sep	680	2500	F	? ?	324	GREEN	
17-Sep	620	1800	F	? ?	325	GREEN	
17-Sep	690	2400	F	? ?	326	GREEN	

18-Sep	520	1200	F	? ?	327	GREEN	
18-Sep	690	2700	F	? ?	098	GREEN	RECAPTURE
Date	**Length (cm)**	**Weight (g)**	**Sex**	**Direction**	**Spag #**	**Tag Color**	**Comment**
18-Sep	680	2800	F	? ?	328	GREEN	
18-Sep	640	2300	F	? ?	329	GREEN	
18-Sep	670	2700	F	? ?	330	GREEN	
18-Sep	490	1100	?	? ?	331	GREEN	
18-Sep	550	1400	F	? ?	332	GREEN	
18-Sep	660	2500	F	? ?	333	GREEN	
18-Sep	760	4200	F	? ?	334	GREEN	
18-Sep	720	3500	F	? ?	335	GREEN	
18-Sep	415	700	?	? ?	336	GREEN	
18-Sep	780	5100	M	? ?	337	GREEN	
18-Sep	810	5000	F	? ?	338	GREEN	
18-Sep	690	2900	F	? ?	160	GREEN	RECAPTURE
18-Sep	660	2600	F	? ?	339	GREEN	
18-Sep	715	3300	F	? ?	064	GREEN	RECAPTURE
18-Sep	515	1300	F	? ?	340	GREEN	
18-Sep	540	1500	F	? ?	218	GREEN	RECAPTURE
18-Sep	670	2700	F	? ?	341	GREEN	
18-Sep	465	1000	?	? ?	342	GREEN	
18-Sep	450	900	?	? ?	343	GREEN	
18-Sep	700	3000	F	? ?	066	GREEN	RECAPTURE
18-Sep	590	2000	F	? ?	135	GREEN	RECAPTURE
18-Sep	440	1000	?	? ?	344	GREEN	
19-Sep	830	5600	F	? ?	345	GREEN	PHOTO #14, ROLL #1
19-Sep	440	900	?	? ?	346	GREEN	
19-Sep	630	2200	F	? ?	347	GREEN	
19-Sep	660	2400	M	? ?	348	GREEN	
19-Sep	610	2000	F	? ?	349	GREEN	
19-Sep	610	2100	F	? ?	350	GREEN	
19-Sep	450	900	?	? ?	351	GREEN	
19-Sep	420	700	?	? ?	352	GREEN	
19-Sep	640	2300	F	? ?	353	GREEN	
19-Sep	665	2600	F	? ?	354	GREEN	
19-Sep	570	1500	F	? ?	355	GREEN	
19-Sep	420	700	?	? ?	356	GREEN	
19-Sep	750	3600	F	? ?	357	GREEN	
19-Sep	665	2400	F	? ?	358	GREEN	
19-Sep	710	3100	M	? ?	359	GREEN	
19-Sep	720	3400	F	? ?	360	GREEN	
19-Sep	735	3700	M	? ?	361	GREEN	
19-Sep	615	2000	F	? ?	362	GREEN	
19-Sep	745	4300	M	? ?	363	GREEN	PHOTO #15, ROLL #1 UPSTREAM
19-Sep	745	3600	F	? ?	364	GREEN	
19-Sep	775	4400	M	? ?	365	GREEN	
19-Sep	465	1000	?	? ?	366	GREEN	
19-Sep	540	1600	F	? ?	367	GREEN	
19-Sep	490	1200	?	? ?	368	GREEN	

19-Sep	650	2300	F	? ?	369	GREEN	
19-Sep	705	3100	F	? ?	370	GREEN	
19-Sep	645	2500	F	? ?	371	GREEN	
Date	**Length (cm)**	**Weight (g)**	**Sex**	**Direction**	**Spag #**	**Tag Color**	**Comment**
19-Sep	665	2900	M	? ?	372	GREEN	
19-Sep	580	2000	F	? ?	373	GREEN	
19-Sep	740	3800	F	? ?	132	GREEN	RECAPTURE
19-Sep	720	3500	F	? ?	374/375	GREEN	DOUBLE TAGGED
20-Sep	830	6000	M	? ?	376	GREEN	PHOTO #16&17, ROLL #1
20-Sep	725	3600	M	? ?	377	GREEN	
20-Sep	760	4100	F	? ?	226	YELLOW	RECAPTURE,RADIO TAG, PHOTO#18,19
20-Sep	750	4400	M	? ?	378	GREEN	
20-Sep	610	2000	F	? ?	379	GREEN	
20-Sep	445	900	?	? ?	380	GREEN	
20-Sep	670	2800	F	? ?	171	GREEN	RECAPTURE
20-Sep	770	3700	F	? ?	381	GREEN	
20-Sep	600	2000	F	? ?	382	GREEN	
20-Sep	820	5400	M	? ?	383	GREEN	
20-Sep	650	2600	F	? ?	384	GREEN	
20-Sep	610	2000	F	? ?	192	GREEN	RECAPTURE
20-Sep	730	3600	F	? ?	161	GREEN	RECAPTURE
20-Sep	670	2600	F	? ?	385	GREEN	
20-Sep	670	2600	F	? ?	386	GREEN	
20-Sep	710	3600	M	? ?	387	GREEN	
20-Sep	635	2500	M	? ?	388	GREEN	
20-Sep	810	6300	F	? ?	389	GREEN	PHOTO #21,ROLL #1 LAST PHOTO
20-Sep	550	1600	F	? ?	390	GREEN	
20-Sep	430	900	?	? ?	391	GREEN	
20-Sep	435	1000	?	? ?	393	GREEN	FLOY TAG G-392 NOT USED
21-Sep	620	2100	F	? ?	394	GREEN	
21-Sep	690	3300	M	? ?	395	GREEN	
21-Sep	660	2500	F	? ?	396/397	GREEN	DOUBLE TAGGED
21-Sep	880	6100	M	? ?	398	GREEN	
21-Sep	840	6100	F	? ?	399	GREEN	
21-Sep	745	3900	M	? ?	400	GREEN	
21-Sep	820	5400	M	? ?	401	GREEN	
21-Sep	540	1600	M	? ?	402/403	GREEN	DOUBLE TAGGED
21-Sep	885	6500	M	? ?	404	GREEN	
21-Sep	540	1600	F	? ?	405	GREEN	
21-Sep	460	1200	?	? ?	406	GREEN	
22-Sep	840	5800	M	? ?	407	GREEN	
22-Sep	590	2100	F	? ?	408	GREEN	FLOY TAG G-409 NOT USED
22-Sep	770	4500	F	? ?	145	GREEN	RECAPTURE
22-Sep	865	6600	M	? ?	410	GREEN	PHOTO #1, ROLL#2
22-Sep	615	2200	F	? ?	411	GREEN	
22-Sep	760	4500	M	? ?	412	GREEN	
22-Sep	760	4100	F	? ?	004	GREEN	RECAPTURE
22-Sep	640	2400	F	? ?	413	GREEN	
22-Sep	550	1600	F	? ?	414	GREEN	

22-Sep	860	6700	M	? ?	415/416	GREEN	DOUBLE TAGGED
22-Sep	850	5900	M	? ?	417	GREEN	
22-Sep	620	2100	F	? ?	418	GREEN	
22-Sep	600	2000	F	? ?	419	GREEN	
Date	**Length (cm)**	**Weight (g)**	**Sex**	**Direction**	**Spag #**	**Tag Color**	**Comment**
22-Sep	400	800	?	? ?	420	GREEN	PHOTO #2&3,ROLL #2
23-Sep	900	7500	M	? ?	421	GREEN	
23-Sep	680	3100	F	? ?	422	GREEN	
23-Sep	685	3000	M	? ?	423	GREEN	
23-Sep	470	1100	?	? ?	424	GREEN	PHOTO #4,ROLL #2
23-Sep	890	7000	M	? ?	425	GREEN	PHOTO #5, ROLL #2
23-Sep	820	4800	F	? ?	068	GREEN	RECAPTURE
23-Sep	665	3000	F	? ?	126	GREEN	RECAPTURE
23-Sep	670	3000	F	? ?	426	GREEN	
23-Sep	590	1900	M	? ?	427	GREEN	
23-Sep	700	3000	M	? ?	428	GREEN	
23-Sep	860	6000	M	? ?	429	GREEN	
23-Sep	770	4500	M	? ?	059	PINK	RECAPTURE
23-Sep	660	3000	F	? ?	430	GREEN	
23-Sep	740	3900	M	? ?	431	GREEN	
23-Sep	585	2200	F	? ?	432	GREEN	
23-Sep	540	1600	F	? ?	433	GREEN	
24-Sep	840	6200	M	? ?	434	GREEN	PHOTO #6,ROLL #2
24-Sep	810	5200	F	? ?	039	GREEN	RECAPTURE
24-Sep	700	3500	M	? ?	435	GREEN	
24-Sep	660	2500	F	? ?	436	GREEN	
24-Sep	740	4000	M	? ?	437/438	GREEN	DOUBLE TAGGED
24-Sep	630	2400	F	? ?	439	GREEN	
24-Sep	740	3800	M	? ?	440	GREEN	PHOTO #7, ROLL #2
24-Sep	560	1900	F	? ?	441	GREEN	
24-Sep	590	2000	M	? ?	442	GREEN	
25-Sep	790	4500	M	? ?	147	YELLOW	RADIO TAGGED
25-Sep	670	2900	F	? ?	146	YELLOW	RADIO TAGGED,PHOTO#8,9,ROLL#2
25-Sep	810	5100	M	? ?	145	YELLOW	RADIO TAGGED,PHOTO#10,11,ROLL#2
25-Sep	640	2400	F	? ?	144	YELLOW	RADIO TAGGED,PHOTO#12,13,14,ROLL2
25-Sep	440	1000	?	? ?	443	GREEN	
25-Sep	620	2400	M	? ?	444	GREEN	
25-Sep	630	2300	M	? ?	445	GREEN	
25-Sep	700	3700	F	? ?	446	GREEN	
25-Sep	630	2300	F	? ?	447	GREEN	
26-Sep	580	1900	F	? ?	448	GREEN	
26-Sep	810	5800	F	? ?	144	GREEN	RECAPTURE
26-Sep	840	5000	F	? ?	170	GREEN	RECAPTURE
26-Sep	700	3400	F	? ?	449	GREEN	
26-Sep	840	5600	M	? ?	450	GREEN	
26-Sep	690	3200	M	? ?	451	GREEN	
26-Sep	620	2300	F	? ?	452	GREEN	
26-Sep	640	2500	F	? ?	453	GREEN	
27-Sep	420	1000	?	? ?	454	GREEN	PHOTO #15,ROLL #2

27-Sep	610	2200	F	? ?	455	GREEN	
27-Sep	430	1000	?	? ?	456	GREEN	
27-Sep	845	6500	M	? ?	457	GREEN	
27-Sep	690	3000	M	? ?	458	GREEN	
27-Sep	830	5500	M	? ?	459	GREEN	
Date	**Length (cm)**	**Weight (g)**	**Sex**	**Direction**	**Spag #**	**Tag Color**	**Comment**
27-Sep	870	6600	M	? ?	460	GREEN	PHOTO #16,ROLL #2
27-Sep	640	2500	M	? ?	461	GREEN	
27-Sep	700	2500	F	? ?	462	GREEN	
28-Sep	550	1800	F	? ?	463	GREEN	
28-Sep	650	2500	F	? ?	464	GREEN	
28-Sep	540	1500	F	? ?	465	GREEN	
28-Sep	535	1400	M	? ?	466	GREEN	
28-Sep	400	800	?	? ?	467	GREEN	PHOTO #17,ROLL #2
29-Sep	680	2600	F	? ?	468	GREEN	
30-Sep	920	7100	M	? ?	469	GREEN	
30-Sep	485	1200	?	? ?	470	GREEN	
01-Oct	780	4600	M	? ?	471	GREEN	
01-Oct	630	2400	F	? ?	472/473	GREEN	DOUBLE TAGGED
01-Oct	630	2300	F	? ?	474	GREEN	
01-Oct	620	2200	M	? ?	475	GREEN	
01-Oct	590	2000	F	? ?	55	GREEN	RECAPTURE
01-Oct	580	1800	F	? ?	476	GREEN	
02-Oct	640	2100	F	? ?	477	GREEN	
02-Oct	730	3300	M	? ?	478	GREEN	FLOY TAG G-479 NOT USED
02-Oct	610	2000	M	? ?	480	GREEN	
03-Oct	580	1700	M	? ?	481	GREEN	
04-Oct	620	2100	F	? ?	482	GREEN	
04-Oct	630	2200	F	? ?	483	GREEN	
05-Oct	740	3500	M	? ?	484	GREEN	
05-Oct	520	1300	F	? ?	485	GREEN	
06-Oct	600	1700	F	? ?	486	GREEN	
06-Oct	545	1300	M	? ?	487	GREEN	
06-Oct	450	800	?	? ?	488	GREEN	
06-Oct	445	600	?	? ?	489	GREEN	
06-Oct	770	3900	M	? ?	490	GREEN	
08-Oct	780	4800	M	? ?	491	GREEN	LAST PHOTOS ON ROLL #2
09-Oct	520	1000	M	? ?	492	GREEN	
11-Oct	580	1500	F	? ?	493	GREEN	